

Appendix D1: Life History Parameter Values Used to Evaluate I&E in the Mid-Atlantic Region

The tables in this appendix present the life history parameter values used by EPA to calculate age 1 equivalents, fishery yields, and production foregone from I&E data for the Mid-Atlantic Region. Because of differences in the number of life stages represented in the loss data, there are cases where more than one life stage sequence was needed for a given species or species group. Alternative parameter sets were developed for this purpose and are indicated with a number following the species or species group name (i.e., Alewife 1, Alewife 2).

Table D1-1: Alewife Life History Parameters 1^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.554	0	0	0.000000716
Yolksac larvae	1.81	0	0	0.000000728
Post-yolksac larvae	1.72	0	0	0.000000335
Juvenile 1	3.11	0	0	0.000746
Juvenile 2	3.11	0	0	0.0155
Age 1+	0.300	0	0	0.0303
Age 2+	0.300	0	0	0.125
Age 3+	0.300	0	0	0.254
Age 4+	0.900	0.1	0.45	0.379
Age 5+	1.50	0.1	0.9	0.485
Age 6+	1.50	0.1	1	0.565
Age 7+	1.50	0.1	1	0.625
Age 8+	1.50	0.1	1	0.666

^a Life history parameters applied to losses from Salem.

Source: PSE&G, 1999.

Table D1-2: Alewife Life History Parameters 2^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.554	0	0	0.000000716
Larvae	3.53	0	0	0.00000204
Juvenile	6.21	0	0	0.000746
Age 1+	0.300	0	0	0.0303
Age 2+	0.300	0	0	0.125
Age 3+	0.300	0	0	0.254
Age 4+	0.900	0.1	0.45	0.379
Age 5+	1.50	0.1	0.9	0.485
Age 6+	1.50	0.1	1.0	0.565
Age 7+	1.50	0.1	1.0	0.625
Age 8+	1.50	0.1	1.0	0.666

^a Life history parameters applied to losses from Calvert Cliffs, Chalk Point, Indian Point, and Morgantown.

Source: PSE&G, 1999.

Table D1-3: American Shad Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.496	0	0	0.000000716
Yolksac larvae	0.496	0	0	0.000000728
Post-yolksac larvae	2.52	0	0	0.00000335
Juvenile	7.4	0	0	0.000746
Age 1+	0.3	0	0	0.309
Age 2+	0.3	0	0	1.17
Age 3+	0.3	0	0	2.32
Age 4+	0.54	0.21	0.45	3.51
Age 5+	1.02	0.21	0.90	4.56
Age 6+	1.5	0.21	1.0	5.47
Age 7+	1.5	0.21	1.0	6.20
Age 8+	1.5	0.21	1.0	6.77

Sources: Able and Fahay, 1998; Froese and Pauly, 2001; PSE&G, 1999; and U.S. Fish and Wildlife Service, 1978.

Table D1-4: Atlantic Croaker Life History Parameters 1^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.817	0	0	0.0000000128
Yolksac larvae	3.27	0	0	0.0000000441
Post-yolksac larvae	4.90	0	0	0.000000246
Juvenile 1	1.18	0	0	0.0000120
Juvenile 2	2.20	0	0	0.000113
Age 1+	1.09	0.3	0.50	0.220
Age 2+	0.300	0.3	1.0	0.672
Age 3+	0.300	0.3	1.0	1.24
Age 4+	0.300	0.3	1.0	1.88
Age 5+	0.300	0.3	1.0	2.43
Age 6+	0.300	0.3	1.0	3.26
Age 7+	0.300	0.3	1.0	3.26
Age 8+	0.300	0.3	1.0	3.26

^a Life history parameters applied to losses from Salem.

Source: PSE&G, 1999.

Table D1-5: Atlantic Croaker Life History Parameters 2^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.817	0	0	0.0000000128
Larvae	8.10	0	0	0.000000145
Juvenile	3.38	0	0	0.0000624
Age 1+	1.09	0.3	0.50	0.220
Age 2+	0.300	0.3	1.0	0.672
Age 3+	0.300	0.3	1.0	1.24
Age 4+	0.300	0.3	1.0	1.88
Age 5+	0.300	0.3	1.0	2.43
Age 6+	0.300	0.3	1.0	3.26
Age 7+	0.300	0.3	1.0	3.26
Age 8+	0.300	0.3	1.0	3.26

^a Life history parameters applied to losses from Calvert Cliffs, Chalk Point, Indian River, and Morgantown.

Source: PSE&G, 1999.

Table D1-6: Atlantic Menhaden Life History Parameters 1^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.08	0	0	0.000000716
Yolksac larvae	2.85	0	0	0.000000728
Post-yolksac larvae	2.85	0	0	0.00000335
Juvenile	2.85	0	0	0.000746
Age 1+	0.450	0	0	0.0937
Age 2+	0.450	0.8	0.50	0.356
Age 3+	0.450	0.8	1.0	0.679
Age 4+	0.450	0.8	1.0	0.974
Age 5+	0.450	0.8	1.0	1.21
Age 6+	0.450	0.8	1.0	1.38

^a Life history parameters applied to losses from Salem.

Sources: ASMFC, 2001b; Durbin et al., 1983; Entergy Nuclear Generation Company, 2000; Froese and Pauly, 2001; Ruppert et al., 1985; and U.S. Fish and Wildlife Service, 1978.

Table D1-7: Atlantic Menhaden Life History Parameters 2^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.07	0	0	0.000000716
Larvae	5.71	0	0	0.00000204
Juvenile	2.85	0	0	0.000746
Age 1+	0.45	0	0	0.0937
Age 2+	0.45	0.8	0.50	0.356
Age 3+	0.45	0.8	1.0	0.679
Age 4+	0.45	0.8	1.0	0.974
Age 5+	0.45	0.8	1.0	1.21
Age 6+	0.45	0.8	1.0	1.38

^a Life history parameters applied to losses from Calvert Cliffs, Chalk Point, Indian River, and Morgantown.

Sources: ASMFC, 2001b; Durbin et al., 1983; Entergy Nuclear Generation Company, 2000; Froese and Pauly, 2001; Ruppert et al., 1985; and U.S. Fish and Wildlife Service, 1978.

Table D1-8: Atlantic Tomcod Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	8.46	0	0	0.00000126
Larvae	8.46	0	0	0.0000185
Juvenile	8.46	0	0	0.0145
Age 1+	8.46	0	0	0.080
Age 2+	2.83	0	0	0.270
Age 3+	2.83	0	0	0.486

Sources: McLaren *et al.*, 1988; NMFS, 2003a; Stewart and Auster, 1987; and Virginia Tech, 1998.

Table D1-9: Bay Anchovy Life History Parameters 1^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.04	0	0	0.0000000186
Yolksac larvae	1.57	0	0	0.0000000441
Post-yolksac larvae 1	2.11	0	0	0.0000000929
Post-yolksac larvae 2	4.02	0	0	0.00000461
Juvenile 1	0.0822	0	0	0.0000495
Juvenile 2	0.0861	0	0	0.000199
Juvenile 3	0.129	0	0	0.000532
Juvenile 4	0.994	0	0	0.00114
Age 1+	1.62	0	0	0.00381
Age 2+	1.62	0	0	0.00496
Age 3+	1.62	0	0	0.00505

^a Life history parameters applied to losses from Salem.

Sources: Derickson and Price, 1973; NMFS, 2003a; and PSE&G, 1999.

Table D1-10: Bay Anchovy Life History Parameters 2^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.04	0	0	0.0000000186
Larvae	7.70	0	0	0.00000158
Juvenile	1.29	0	0	0.000481
Age 1+	1.62	0	0	0.00381
Age 2+	1.62	0	0	0.00496
Age 3+	1.62	0	0	0.00505

^a Life history parameters applied to losses from Calvert Cliffs, Chalk Point, Indian River, and Morgantown.

Sources: Derickson and Price, 1973; NMFS, 2003a; and PSE&G, 1999.

Table D1-11: Bay Anchovy Life History Parameters 3 ^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.04	0	0	0.0000000186
Yolksac larvae	1.57	0	0	0.0000000441
Post-yolksac larvae	6.12	0	0	0.00000235
Juvenile	1.29	0	0	0.000481
Age 1+	1.62	0	0	0.00381
Age 2+	1.62	0	0	0.00496
Age 3+	1.62	0	0	0.00505

^a Life history parameters applied to losses from Indian Point.

Sources: Derickson and Price, 1973; NMFS, 2003a; and PSE&G, 1999.

Table D1-12: Blue Crab Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Megalops	1.30	0	0	0.00000291
Juvenile	1.73	0.48	0.5	0.00000293
Age 1+	1.10	0.48	1	0.007
Age 2+	1.38	0.48	1	0.113
Age 3+	1.27	0.48	1	0.326

Sources: Hartman, 1993; and PSE&G, 1999.

Table D1-13: Blueback Herring Life History Parameters 1 ^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.558	0	0	0.000000716
Yolksac larvae	1.83	0	0	0.000000728
Post-yolksac larvae	1.74	0	0	0.00000335
Juvenile 1	3.13	0	0	0.000746
Juvenile 2	3.13	0	0	0.00836
Age 1+	0.300	0	0	0.0160
Age 2+	0.300	0	0	0.0905
Age 3+	0.300	0	0	0.204
Age 4+	0.900	0	0	0.318
Age 5+	1.50	0	0	0.414
Age 6+	1.50	0	0	0.488
Age 7+	1.50	0	0	0.540
Age 8+	1.50	0	0	0.576

^a Life history parameters applied to losses from Salem.

Sources: NMFS, 2003a; and PSE&G, 1999.

Table D1-14: Blueback Herring Life History Parameters 2^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.558	0	0	0.000000716
Larvae	3.18	0	0	0.00000204
Juvenile	6.26	0	0	0.000746
Age 1+	0.300	0	0	0.0160
Age 2+	0.300	0	0	0.0905
Age 3+	0.300	0	0	0.204
Age 4+	0.900	0	0	0.318
Age 5+	1.50	0	0	0.414
Age 6+	1.50	0	0	0.488
Age 7+	1.50	0	0	0.540
Age 8+	1.50	0	0	0.576

^a Life history parameters applied to losses from Calvert Cliffs, Chalk Point, and Indian Point.

Sources: NMFS, 2003a; and PSE&G, 1999.

Table D1-15: Hogchoker Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.04	0	0	0.000000487
Larvae	5.20	0	0	0.00110
Juvenile	2.31	0	0	0.00207
Age 1+	2.56	0	0	0.0113
Age 2+	0.705	0	0	0.0313
Age 3+	0.705	0	0	0.0610
Age 4+	0.705	0	0	0.0976
Age 5+	0.705	0	0	0.138
Age 6+	0.705	0	0	0.178

Sources: Froese and Pauly, 2003; NMFS, 2003a; and PG&E National Energy Group, 2001.

Table D1-16: Naked Goby Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.288	0	0	0.0000370
Larvae	4.09	0	0	0.000221
Juvenile	2.30	0	0	0.000485
Age 1+	2.55	0	0	0.00205

Sources: Froese and Pauly, 2003; and PG&E National Energy Group, 2001.

Table D1-17: Spot Life History Parameters 1^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.825	0	0	0.000000131
Yolksac larvae	3.30	0	0	0.000000154
Post-yolksac larvae	4.12	0	0	0.000000854
Juvenile 1	1.58	0	0	0.0000226
Juvenile 2	0.99	0.247	0.30	0.000220
Age 1+	0.463	0.40	1.0	0.0791
Age 2+	0.400	0.40	1.0	0.299
Age 3+	0.400	0.40	1.0	0.507
Age 4+	0.400	0.40	1.0	0.648
Age 5+	0.400	0.40	1.0	0.732
Age 6+	0.400	0.40	1.0	0.779
Age 7+	0.400	0.40	1.0	0.779
Age 8+	0.400	0.40	1.0	0.779
Age 9+	0.400	0.40	1.0	0.779
Age 10+	0.400	0.40	1.0	0.779
Age 11+	0.400	0.40	1.0	0.779
Age 12+	0.400	0.40	1.0	0.779
Age 13+	0.400	0.40	1.0	0.779
Age 14+	0.400	0.40	1.0	0.779
Age 15+	0.400	0.40	1.0	0.779

^a Life history parameters applied to losses from Salem.

Sources: PSE&G, 1984b, 1999; and Schwartz et al., 1979.

Table D1-18: Spot Life History Parameters 2^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.825	0	0	0.000000131
Larvae	7.40	0	0	0.000000504
Juvenile	2.57	0	0	0.000121
Age 1+	0.463	0.40	1.0	0.0791
Age 2+	0.400	0.40	1.0	0.299
Age 3+	0.400	0.40	1.0	0.507
Age 4+	0.400	0.40	1.0	0.648
Age 5+	0.400	0.40	1.0	0.732
Age 6+	0.400	0.40	1.0	0.779
Age 7+	0.400	0.40	1.0	0.779
Age 8+	0.400	0.40	1.0	0.779
Age 9+	0.400	0.40	1.0	0.779
Age 10+	0.400	0.40	1.0	0.779
Age 11+	0.400	0.40	1.0	0.779
Age 12+	0.400	0.40	1.0	0.779
Age 13+	0.400	0.40	1.0	0.779
Age 14+	0.400	0.40	1.0	0.779
Age 15+	0.400	0.40	1.0	0.779

^a Life history parameters applied to losses from Calvert Cliffs, Chalk Point, Indian River, and Morgantown.

Sources: PSE&G, 1984b, 1999; and Schwartz *et al.*, 1979.

Table D1-19: Striped Bass Life History Parameters 1^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.39	0	0	0.000000224
Yolksac larvae	2.22	0	0	0.000000243
Post-yolksac larvae	5.11	0	0	0.0000119
Juvenile 1	2.28	0	0	0.000154
Juvenile 2	1.00	0	0	0.0216
Age 1+	1.10	0	0	0.485
Age 2+	0.150	0.31	0.06	2.06
Age 3+	0.150	0.31	0.20	3.31
Age 4+	0.150	0.31	0.63	4.93
Age 5+	0.150	0.31	0.94	6.50
Age 6+	0.150	0.31	1.0	8.58
Age 7+	0.150	0.31	0.90	12.3
Age 8+	0.150	0.31	0.90	14.3
Age 9+	0.150	0.31	0.90	16.1
Age 10+	0.150	0.31	0.90	18.8
Age 11+	0.150	0.31	0.90	19.6
Age 12+	0.150	0.31	0.90	22.4
Age 13+	0.150	0.31	0.90	27.0
Age 14+	0.150	0.31	0.90	34.6
Age 15+	0.150	0.31	0.90	41.5

^a Life history parameters applied to losses from Salem.

Sources: Bason, 1971; and PSE&G, 1999.

Table D1-20: Striped Bass Life History Parameters 2^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.39	0	0	0.000000224
Larvae	7.32	0	0	0.00000606
Juvenile	3.29	0	0	0.0109
Age 1+	1.10	0	0	0.485
Age 2+	0.150	0.31	0.06	2.06
Age 3+	0.150	0.31	0.20	3.31
Age 4+	0.150	0.31	0.63	4.93
Age 5+	0.150	0.31	0.94	6.5
Age 6+	0.150	0.31	1.0	8.58
Age 7+	0.150	0.31	0.90	12.3
Age 8+	0.150	0.31	0.90	14.3
Age 9+	0.150	0.31	0.90	16.1
Age 10+	0.150	0.31	0.90	18.8
Age 11+	0.150	0.31	0.90	19.6
Age 12+	0.150	0.31	0.90	22.4
Age 13+	0.150	0.31	0.90	27
Age 14+	0.150	0.31	0.90	34.6
Age 15+	0.150	0.31	0.90	41.5

^a Life history parameters applied to losses from Calvert Cliffs, Chalk Point, and Morgantown.

Sources: Bason, 1971; and PSE&G, 1999.

Table D1-21: Striped Bass Life History Parameters 3^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.39	0	0	0.000000224
Yolksac larvae	2.22	0	0	0.000000243
Post-yolksac larvae	5.11	0	0	0.0000119
Juvenile	3.29	0	0	0.248
Age 1+	1.10	0	0	0.485
Age 2+	0.150	0.31	0.06	2.06
Age 3+	0.150	0.31	0.20	3.31
Age 4+	0.150	0.31	0.63	4.93
Age 5+	0.150	0.31	0.94	6.50
Age 6+	0.150	0.31	1.0	8.58
Age 7+	0.150	0.31	0.90	12.3
Age 8+	0.150	0.31	0.90	14.3
Age 9+	0.150	0.31	0.90	16.1
Age 10+	0.150	0.31	0.90	18.8
Age 11+	0.150	0.31	0.90	19.6
Age 12+	0.150	0.31	0.90	22.4
Age 13+	0.150	0.31	0.90	27
Age 14+	0.150	0.31	0.90	34.6
Age 15+	0.150	0.31	0.90	41.5

^a Life history parameters applied to losses from Indian Point.

Sources: Bason, 1971; and PSE&G, 1999.

Table D1-22: Summer Flounder Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.288	0	0	0.00000109
Larvae	4.37	0	0	0.00000532
Juvenile	2.38	0	0	0.208
Age 1+	0.200	0.26	0.50	0.919
Age 2+	0.200	0.26	1.0	1.02
Age 3+	0.200	0.26	1.0	2.50
Age 4+	0.200	0.26	1.0	3.56
Age 5+	0.200	0.26	1.0	5.09
Age 6+	0.200	0.26	1.0	5.83
Age 7+	0.200	0.26	1.0	6.64
Age 8+	0.200	0.26	1.0	8.16
Age 9+	0.200	0.26	1.0	9.90
Age 10+	0.200	0.26	1.0	11.9
Age 11+	0.200	0.26	1.0	14.1
Age 12+	0.200	0.26	1.0	16.6
Age 13+	0.200	0.26	1.0	19.4
Age 14+	0.200	0.26	1.0	22.5

Sources: Bolz et al., 1999; Froese and Pauly, 2003; Grimes et al., 1989; NOAA, 2001c; PG&E National Energy Group, 2001; Packer et al., 1999; and Wang and Kernehan, 1979.

Table D1-23: Weakfish Life History Parameters 1^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.04	0	0	0.0000000787
Yolksac larvae	1.34	0	0	0.0000000882
Post-yolksac larvae	6.33	0	0	0.000000382
Juvenile 1	2.44	0	0	0.0000184
Juvenile 2	1.48	0	0	0.0502
Age 1+	0.349	0.25	0.10	0.260
Age 2+	0.250	0.25	0.50	0.680
Age 3+	0.250	0.25	1.0	1.12
Age 4+	0.250	0.25	1.0	1.79
Age 5+	0.250	0.25	1.0	2.91
Age 6+	0.250	0.25	1.0	6.21
Age 7+	0.250	0.25	1.0	7.14
Age 8+	0.250	0.25	1.0	9.16
Age 9+	0.250	0.25	1.0	10.8
Age 10+	0.250	0.25	1.0	12.5
Age 11+	0.250	0.25	1.0	12.5
Age 12+	0.250	0.25	1.0	12.5
Age 13+	0.250	0.25	1.0	12.5
Age 14+	0.250	0.25	1.0	12.5
Age 15+	0.250	0.25	1.0	12.5

^a Life history parameters applied to losses from Salem.

Sources: PSE&G, 1999; and Thomas, 1971.

Table D1-24: Weakfish Life History Parameters 2^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.04	0	0	0.0000000787
Larvae	7.70	0	0	0.000000235
Juvenile	3.92	0	0	0.0251
Age 1+	0.349	0.25	0.10	0.260
Age 2+	0.250	0.25	0.50	0.680
Age 3+	0.250	0.25	1.0	1.12
Age 4+	0.250	0.25	1.0	1.79
Age 5+	0.250	0.25	1.0	2.91
Age 6+	0.250	0.25	1.0	6.21
Age 7+	0.250	0.25	1.0	7.14
Age 8+	0.250	0.25	1.0	9.16
Age 9+	0.250	0.25	1.0	10.8
Age 10+	0.250	0.25	1.0	12.5
Age 11+	0.250	0.25	1.0	12.5
Age 12+	0.250	0.25	1.0	12.5
Age 13+	0.250	0.25	1.0	12.5
Age 14+	0.250	0.25	1.0	12.5
Age 15+	0.250	0.25	1.0	12.5

^a Life history parameters applied to losses from Calvert Cliffs, Chalk Point, and Indian River.

Sources: PSE&G, 1999; and Thomas, 1971.

Table D1-25: White Perch Life History Parameters 1^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.75	0	0	0.000000330
Yolksac larvae	2.10	0	0	0.000000353
Post-yolksac larvae	3.27	0	0	0.00000507
Juvenile 1	0.947	0	0	0.000317
Juvenile 2	0.759	0	0	0.00486
Age 1+	0.693	0	0	0.0198
Age 2+	0.693	0	0	0.0567
Age 3+	0.693	0.15	0.00080	0.103
Age 4+	0.689	0.15	0.027	0.150
Age 5+	1.58	0.15	0.21	0.214
Age 6+	1.54	0.15	0.48	0.265
Age 7+	1.48	0.15	0.84	0.356
Age 8+	1.46	0.15	1.0	0.387
Age 9+	1.46	0.15	1.0	0.516
Age 10+	1.46	0.15	1.0	0.619

^a Life history parameters applied to losses from Salem.

Sources: Horseman and Shirey, 1974; and PSE&G, 1999.

Table D1-26: White Perch Life History Parameters 2^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.75	0	0	0.000000330
Larvae	5.37	0	0	0.00000271
Juvenile	1.71	0	0	0.00259
Age 1+	0.693	0	0	0.0198
Age 2+	0.693	0	0	0.0567
Age 3+	0.693	0.15	0.00080	0.103
Age 4+	0.689	0.15	0.027	0.150
Age 5+	1.58	0.15	0.21	0.214
Age 6+	1.54	0.15	0.48	0.265
Age 7+	1.48	0.15	0.84	0.356
Age 8+	1.46	0.15	1.0	0.387
Age 9+	1.46	0.15	1.0	0.516
Age 10+	1.46	0.15	1.0	0.619

^a Life history parameters applied to losses from Calvert Cliffs, Chalk Point, and Morgantown.

Sources: Horseman and Shirey, 1974; and PSE&G, 1999.

Table D1-27: White Perch Life History Parameters 3^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.75	0	0	0.000000330
Yolksac larvae	2.10	0	0	0.000000353
Post-yolksac larvae	3.27	0	0	0.000000507
Juvenile	1.71	0	0	0.00259
Age 1+	0.693	0	0	0.0198
Age 2+	0.693	0	0	0.0567
Age 3+	0.693	0.15	0.00080	0.103
Age 4+	0.689	0.15	0.027	0.150
Age 5+	1.58	0.15	0.21	0.214
Age 6+	1.54	0.15	0.48	0.265
Age 7+	1.48	0.15	0.84	0.356
Age 8+	1.46	0.15	1.0	0.387
Age 9+	1.46	0.15	1.0	0.516
Age 10+	1.46	0.15	1.0	0.619

^a Life history parameters applied to losses from Indian Point.

Sources: Horseman and Shirey, 1974; and PSE&G, 1999.

Table D1-28: Windowpane Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.41	0	0	0.00000154
Larvae	6.99	0	0	0.00165
Juvenile	2.98	0	0	0.00223
Age 1+	0.420	0	0	0.0325
Age 2+	0.420	1.6	0.25	0.122
Age 3+	0.420	1.6	0.61	0.265
Age 4+	0.420	1.6	1.0	0.433
Age 5+	0.420	1.6	1.0	0.603
Age 6+	0.420	1.6	1.0	0.761
Age 7+	0.420	1.6	1.0	0.899
Age 8+	0.420	1.6	1.0	1.02
Age 9+	0.420	1.6	1.0	1.11
Age 10+	0.420	1.6	1.0	1.19

Sources: Froese and Pauly, 2003; Hendrickson, 2000; PG&E National Energy Group, 2001; and USGen New England, 2001.

Table D1-29: Winter Flounder Life History Parameters				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	0.288	0	0	0.00000115
Larvae	4.37	0	0	0.0138
Juvenile	2.38	0	0	0.0330
Age 1+	1.10	0.24	0.01	0.208
Age 2+	0.924	0.24	0.29	0.562
Age 3+	0.200	0.24	0.80	0.997
Age 4+	0.200	0.24	0.92	1.42
Age 5+	0.200	0.24	0.83	1.78
Age 6+	0.200	0.24	0.89	2.07
Age 7+	0.200	0.24	0.89	2.29
Age 8+	0.200	0.24	0.89	2.45
Age 9+	0.200	0.24	0.89	2.57
Age 10+	0.200	0.24	0.89	2.65
Age 11+	0.200	0.24	0.89	2.71
Age 12+	0.200	0.24	0.89	2.75
Age 13+	0.200	0.24	0.89	2.78
Age 14+	0.200	0.24	0.89	2.80
Age 15+	0.200	0.24	0.89	2.82
Age 16+	0.200	0.24	0.89	2.83

Sources: Able and Fahay, 1998; Colarusso, 2000; Nitschke et al., 2000; and PG&E National Energy Group, 2001.

Table D1-30: Other Commercial Species Life History Parameters^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.08	0	0	0.000000716
Larvae	5.71	0	0	0.00000204
Juvenile	2.85	0	0	0.000746
Age 1+	0.450	0	0	0.0937
Age 2+	0.450	0.80	0.5	0.356
Age 3+	0.450	0.80	1.0	0.679
Age 4+	0.450	0.80	1.0	0.974
Age 5+	0.450	0.80	1.0	1.21
Age 6+	0.450	0.80	1.0	1.38

^a Includes American butterfish, American eel, brown bullhead, channel catfish, conger eel, gizzard shad, harvestfish, silver hake, white catfish, and yellow perch.

Sources: Able and Fahay, 1998; Durbin et al., 1983; PSE&G, 1999.

Table D1-31: Other Recreational Species Life History Parameters^a

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.08	0	0	0.000000716
Larvae	5.71	0	0	0.00000204
Juvenile	2.85	0	0	0.000746
Age 1+	0.450	0	0	0.0937
Age 2+	0.450	0.80	0.5	0.356
Age 3+	0.450	0.80	1.0	0.679
Age 4+	0.450	0.80	1.0	0.974
Age 5+	0.450	0.80	1.0	1.21
Age 6+	0.450	0.80	1.0	1.38

^a Includes black drum, black sea bass, bluefish, northern puffer, northern searobin, orange filefish, oyster toadfish, sea lamprey, spotted hake, and spotted seatrout.

Sources: Able and Fahay, 1998; ASMFC, 2001b; Durbin et al., 1983; Entergy Nuclear Generation Company, 2000; PSE&G, 1999; Ruppert et al., 1985; and U.S. Fish and Wildlife Service, 1978.

Table D1-32: Other Recreational/Commercial Species Life History Parameters^a				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	2.08	0	0	0.000000716
Yolksac larvae	2.85	0	0	0.000000728
Post-yolksac larvae	2.85	0	0	0.00000335
Juvenile 1	1.43	0	0	0.000746
Juvenile 2	1.43	0	0	0.0472
Age 1+	0.450	0	0	0.0937
Age 2+	0.450	0.80	0.5	0.356
Age 3+	0.450	0.80	1.0	0.679
Age 4+	0.450	0.80	1.0	0.974
Age 5+	0.450	0.80	1.0	1.21
Age 6+	0.450	0.80	1.0	1.38

^a Includes species designated as other commercial from Salem.

Sources: Able and Fahay, 1998; ASMFC, 2001b; Durbin et al., 1983; Entergy Nuclear Generation Company, 2000; PSE&G, 1999; Ruppert et al., 1985; and U.S. Fish and Wildlife Service, 1978.

Table D1-33: Other Forage Species Life History Parameters 1^{a,b}				
Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.04	0	0	0.0000000186
Yolksac larvae	1.57	0	0	0.0000000441
Post-yolksac larvae 1	2.11	0	0	0.0000000929
Post-yolksac larvae 2	4.02	0	0	0.00000461
Juvenile 1	0.0822	0	0	0.0000495
Juvenile 2	0.0861	0	0	0.000199
Juvenile 3	0.129	0	0	0.000532
Juvenile 4	0.994	0	0	0.001161
Age 1+	1.62	0	0	0.00381
Age 2+	1.62	0	0	0.00496
Age 3+	1.62	0	0	0.00505

^a Life history parameters applied to losses from Salem.

^b Includes species designated as other forage from Salem.

Sources: Derickson and Price, 1973; and PSE&G, 1999.

Table D1-34: Other Forage Species Life History Parameters 2^{a,b}

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.04	0	0	0.0000000186
Larvae	7.70	0	0	0.000000158
Juvenile	1.29	0	0	0.000481
Age 1+	1.62	0	0	0.00381
Age 2+	1.62	0	0	0.00496
Age 3+	1.62	0	0	0.00505

^a Life history parameters applied to losses from Calvert Cliffs, Chalk Point, Indian Point, Indian River, and Morgantown.

^b Includes Atlantic herring, Atlantic needlefish, Atlantic silverside, banded killifish, blackcheek tonguefish, bluegill, chain pickerel, fourspine stickleback, golden shiner, inland silverside, inshore lizardfish, lined seahorse, mississippi silvery minnow, mud minnow, mummichog, northern pipefish, northern stargazer, pumpkinseed, sheepshead minnow, skillettish, spottail shiner, spotted codling, striped anchovy, striped blenny, striped killifish, threespine stickleback, and other organisms not identified to species.

Sources: Derickson and Price, 1973; and PSE&G, 1999.

Table D1-35: Other Forage Species Life History Parameters 3^{a,b}

Stage Name	Natural Mortality (per stage)	Fishing Mortality (per stage)	Fraction Vulnerable to Fishery	Weight (lbs)
Eggs	1.04	0	0	0.0000000186
Yolksac larvae	1.57	0	0	0.0000000441
Post-yolksac larvae	6.10	0	0	0.00000662
Juvenile	1.29	0	0	0.000481
Age 1+	1.62	0	0	0.00381
Age 2+	1.62	0	0	0.00496
Age 3+	1.62	0	0	0.00505

^a Life history parameters applied to losses from Calvert Cliffs, Indian Point, and Salem.

^b Includes inland silverside, river herring, and silversides not identified to species.

Sources: Derickson and Price, 1973; and PSE&G, 1999.